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### The Description of International Boundaries

STEPHEN B. JONES

Cases of international discord of serious nature have been caused by slight and unintentional ambiguities in the description of boundaries in formal documents. These flaws may be due to unfamiliarity with the peculiarities of the geographical features, human or natural, along which the boundary extends, or to lack of knowledge of the pitfalls in boundary description.<sup>1</sup> The wisest settlement of a territorial dispute may lead to friction if the description of the boundary in the treaty or award does not correspond to geographical realities. Words that seem simple and straightforward may prove stumbling-blocks when surveyors endeavor to demarcate the line upon the ground. A border officer in future years may wrestle with some problem that began, almost literally, in a slip of the pen.

The suggestions in this paper are intended to help clarify the verbal description of international boundaries in diplomatic notes, treaties, and other documents in which the avoidance of ambiguity is essential. This paper does not attempt to say what constitutes a good international bound-

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<sup>1</sup> Numerous cases are described in the following:

T. Holdich: *Political Frontiers and Boundary Making*, London, 1916.

S. W. Boggs: *International Boundaries*, New York, 1940.

A. R. Hinks: *Notes on the Technique of Boundary Delimitation*, *Geogr. Journ.*, Vol. 58 (1921), pp. 417-43.

E. H. M. Clifford: *Boundary Commissions*, *Royal Engineers Journ.*, Vol. 51 (1937), pp. 363-74.

ary, except for occasional comments on particular types. The goodness or badness of a boundary depends as much upon the general political situation as upon the virtues or defects of the line itself. A boundary, like the human skin, may have diseases of its own or may reflect the illnesses of the body. The same line may be a good boundary at one time, a bad one at another.<sup>2</sup> All boundaries, "natural" or "artificial," are works of man and are respected or violated by that unpredictable species. It may be that no international boundary is good, that the best is evil. It seems probable, however, that international boundaries, perhaps stripped of some of their sovereign functions, will be necessary evils for a while longer. This paper proceeds from that assumption, and from a second assumption that future boundaries, though perhaps more permeable than today's, will not be less sharp. It deals with one phase of boundary craftsmanship—description in formal documents.

This paper does not give "sample descriptions" for boundaries. To do so would be unwise, for no two border areas or boundary sites are exactly alike. Boundary description cannot be reduced to a set of rules. It is an earth science rather than a branch of law or grammar. A boundary is not a page in a treaty or a line on a map. Foremost in the mind of the describer must be an awareness of the boundary as a line on the ground—ultimately, in many cases, a structure on the ground, as material and visible as a road or wall. As a result of condensation, many of the following suggestions may seem to be given as rigid rules. If they appear to be rules, at least they are rules which should be broken if the facts of the earth so dictate. There has been no intention to write a "cook-book" for boundary description. "Guide-book" is a more appropriate term. For most of these suggestions, there is backing from the literature or the comments of critics.

#### RECONNAISSANCE

It is highly desirable that no boundary be described irrevocably in a treaty until a technical adviser experienced in boundary problems has been consulted. It is also desirable that this adviser reconnoiter the site of the proposed boundary before the description is phrased finally. This reconnaissance need not consume much time but may prevent the adoption of unsuitable lines and reveal inaccuracies in maps. The reconnaissance will show which method of description (see below) is most suitable for each portion of the boundary. Aerial reconnaissance may be employed in some cases but should not be considered a complete substitute for ground observation.

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<sup>2</sup> S. B. Jones: *The Forty-ninth Parallel in the Great Plains: the Historical Geography of a Boundary*, *Journ. of Geogr.*, Vol. 31 (1932), pp. 357-67.

## TEXT AND MAP

The description should be illustrated by a map of scale appropriate to the case, but this map should not be considered a substitute for precision in the text. The map employed should be completely identified in the text.<sup>3</sup> Mention of "the annexed map" is insufficient. The identification might include publisher, title, scale, date, projection, and any other pertinent facts. It should be stated that the text overrules the map in case of contradiction. (In a few cases, the contrary has been stipulated.)

The verbal description must fit the terrain rather than the map. If the map is old, do not assume that a locality shown on it necessarily exists. Description in terms of the map should be avoided. ("Above" for "north of"; "down" for "southward"; "beginning at the letter M of the word Millville."<sup>4</sup>) On maps of 1:1,000,000 or even larger scale, details may be inaccurate. The course of a river at a specific point might be incorrectly shown. On a map of 1:1,000,000 scale, the line used to indicate a boundary may cover a belt a half-mile in breadth. Since even a large-scale map is not a replica of the earth, the treaty, though exact in what it specifies, must anticipate the need for adjustments when the line is surveyed. It is a common practice to include a clause empowering the demarcation commission to recommend adjustments.

Boundary descriptions may be used by diplomats, lawyers, surveyors, cartographers, and engineers. Therefore the text should be as free as possible of terms peculiar to one profession. (E.g., French diplomatic, Latin legal, and mathematical engineering terms.) However, technical terms are less to be feared than general terms of vague or multiple meaning. ("Thalweg" is better than "channel," but "deepest continuous channel" may be better than "thalweg.") If possible, translations of boundary descriptions should be checked by someone familiar with technical terms in the foreign language. If the document is prepared in more than one language, one should be stated to rule in case of discrepancy.

## OTHER GENERAL PRINCIPLES

For the purpose of description, each boundary should be thought of as a unique case. A description that is appropriate to one river may not fit another. It is better, where possible, to identify a particular point by name, bearings, or coordinates than to rely on such general terms as "mouth of the White River" or "outlet of Black Lake."

<sup>3</sup> The importance of map identification is evidenced by the Report of the Commission entrusted by the Council with the Study of the Frontier between Syria and Iraq, League of Nations, Geneva, 1932, p. 15.

<sup>4</sup> Letters in place names were given as turning points in the Treaty of Sofia of 1915, quoted in the *Geogr. Rev.*, Vol. 9 (1920), p. 304.

Contradictory definition must be guarded against. Attempts to make a description doubly clear may result in contradiction. To say that a boundary follows "the highest crests which may divide the waters"<sup>5</sup> or "in the middle of the river along the channel" is to invite trouble. Loose use of superlatives should be avoided. ("Highest peaks," "nearest the coast.")

It is customary to describe a boundary continuously from one end to the other, as if one were following it on the ground. It is important to keep the direction of progress in mind in giving the bearing of a straight segment or in stating whether a stream is followed up or down. Every segment of the boundary should be accounted for, even though some are described as "lines to be determined by the demarcation commission." No segment, however short, should be overlooked.

Ease or cheapness of demarcation, maintenance, or administration should not be the ruling consideration in the choice and description of boundaries, but need not be ignored. Short straight segments are easier to demarcate than curved, other things being equal. Short straight segments between intervisible monuments are convenient for administration. Natural marking (streams, lakes, hills, etc.) is not necessary or always desirable. In fact, the long controversy over the rival merits of "natural" and "artificial" boundaries has proved to have little meaning.

#### METHODS OF DESCRIPTION

There are seven main methods of boundary description. A single document may employ several of them, for different parts of a boundary. They are:

1. Complete description: The attempt is made to describe a line so completely that demarcation is merely a surveying job. Complete description really belongs in the final report of the demarcation commission rather than in the prior treaty. In modern practice, this method usually is replaced by the second.

2. Complete description, with power to deviate: The line is described as completely as possible, but the demarcators are given power to make adjustments necessary to fit it to geographical realities. The powers and procedure of the demarcation commission in respect to such adjustments should be stated carefully, to avoid actions which may be contested. Sometimes a limit is placed on the permitted deviations: They must be "minor," not more than a certain distance, must not produce awkward angles, or must be compensated elsewhere.

<sup>5</sup> The phrase which produced a threat of war between Argentina and Chile. See Boggs or Hinks, *op. cit.*

3. By major turning points: The major turning points or angles of the boundary are described. The demarcation commission determines the courses between them. This method requires map and field data sufficiently accurate for the choice of unmistakable turning points. The points may be described by latitude and longitude or other coordinates, by bearings to landmarks, or in other precise terms.

4. By courses and distances: The boundary is described as one would a ship's path. This method (a form of complete description) may be suitable for boundaries in water bodies. It is sometimes combined with description by turning points. If this is done, one method should be stated to rule in case of contradiction. The turning point method is superior in that an error affects only two segments. An error in a course or distance affects all subsequent locations.

5. By a zone: It may be specified that the boundary is to lie between the villages of Hightown and Lowtown, or is to leave one to Leftland and the other to Rightland. This method may be suitable for boundaries determined primarily by human features, such as language.<sup>6</sup> Or the zone may be limited by two rivers or two arbitrary lines. It should be remembered that the demarcation commission probably will feel constrained to divide the zone approximately equally.

6. By natural features: A boundary may be described as following a certain river, mountain range, waterparting, etc., without attempting a complete description of the course of the boundary along the natural feature. This method has given much trouble, chiefly because of inaccurate or inadequate maps. If reliable, large-scale maps exist, it is well to augment the description by identifying the major turning points. Especial care must be given to the junctures of naturally-marked segments with adjoining segments. (Where does the boundary reach and leave a river? What is the course by which it attains a waterparting? How does it reach the summit of a named mountain?)

7. Description in principle: The demarcation commission may, for example, be instructed to determine a line separating the holdings of two tribes or to divide water sources equitably. This method is seldom employed for an entire boundary but is sometimes used for portions of a boundary or in defining the power of the commission to deviate from the described line. Care should be taken to avoid contradictory definition. A contradiction may arise if description in principle is mixed with other methods.<sup>7</sup> ("Due north from Zumzum Well, dividing the lands of tribe A from those of tribe B.")

<sup>6</sup> It was used in the Treaty of Versailles, Art. 27, par. 7, for some segments of the German-Polish boundary.

<sup>7</sup> Cf. Clifford, *op. cit.*, on the Ethiopia-Italian Somaliland delimitation, p. 369.

## COMMON ERRORS IN DESCRIPTION

Among the common errors in boundary description are the following:

1. Vagueness: Almost all topographic terms, like "crest," "main range," "foothills," "source," "mouth," "middle," and "bank," are vague. (It is an excellent plan for a document to contain definitions of the topographical terms used in its text.) Most place names refer to areas rather than points or lines. Even a river has area. This is a matter of moment to the demarcator, whose instruments are capable of determining a point or line with great precision.
2. Description based on inaccurate or inadequate maps or field knowledge.
3. Failure to allow for the many irregularities and possible surprises in natural features and the intricate dovetailing of human features.
4. Use of geometrical terms like "axis," "perpendicular," or "parallel" in relation to irregular features such as mountains, rivers, or coastlines.
5. Contradictory statements, perhaps arising from double definition or from imperfect correlation with earlier documents.

## MOUNTAIN BOUNDARIES

Mountains are not necessarily great barriers either to settlement or transportation. Mountains in many cases are centers of settlement and nodes of transportation in tropical forests and in deserts, and may so serve in middle and even high latitudes, if power, minerals, pasture, or timber are important.

Mountain systems may be fairly regular in general form, seen on a map or from a distance, but they are nearly always surprisingly irregular in detail. It is wise to use only the non-committal term, "mountains," in preference to "range," "chain," or "massif." Avoid geometrical terms like "parallel" and "perpendicular." The terms, "foothills" and "foot of the hills" are vague and have given trouble.<sup>8</sup> "Crest" might refer to the waterparting (hydrographic crest), the high peaks (orographic crest), or the summits of the steepest slopes (transportational or military crest). These three lines (if, indeed, they are lines and not zones) may be far apart. "Highest," a superlative, must be used with care.

Detailed description of mountain boundaries is difficult unless accurate, large-scale, contoured maps are available. It is wise to give the demarcation commission power to substitute straight or other arbitrary lines for irregular natural lines in mountains, if such substitution will simplify the administration of the boundary.

<sup>8</sup> Holdich, *op. cit.*, pp. 193-4.



## WATERPARTING BOUNDARIES

A waterparting is by no means always a barrier, or along a line of hills or mountains, or even visible. Its chief virtues as a boundary are that, with certain exceptions, detailed in the next paragraph, it is precise, and that it separates drainage basins, which for many purposes are best treated as units under a single government.

Some peculiarities of waterpartings are: (1) They often lie well away from the zone of high peaks. (2) Along the waterparting may be lakes and swamps with outlets in both directions. (3) There may be streams and even large rivers which split and drain in two directions. (4) The waterparting may be extremely crooked. (5) Underground drainage may prevent ready determination of the waterparting. (6) Basins without drainage to the sea (due to evaporation) may bifurcate the waterparting. (7) In extremely flat regions the waterparting may be hard to locate. These details can be known only from accurate maps or careful reconnaissance.

A waterparting may not be a barrier, even if it lies within mountains. Canyons lower down the streams may be more serious obstacles. Pastures along the waterparting may be common property of communities on both flanks.<sup>9</sup> A mountain system may include the waterparting for small rivers, but be traversed by a few large ones.

We can recognize two waterpartings: (1) The true waterparting is the actual dividing line of the waters, and therefore requires knowledge of underground circulation where streams sink. Such knowledge may be unobtainable. The true waterparting may be bifurcated by basins of interior drainage. (2) The surface waterparting is the line at which the waters would divide if there were no evaporation or underground drainage. It is probably best to specify the surface waterparting and to give the demarcators power to ignore minor irregularities.

## DESERT BOUNDARIES

Great deserts are barriers but may not offer naturally-marked sites for boundaries. Watercourses and mountains in deserts usually are centers of population or nodes of travel. The low value of most desert land should permit a flexible definition, say by major turning points, with much power given the demarcation commission.

Since the inhabitants of many deserts are either nomads or oasis dwellers, allocation of water supplies is very important. If adequate data are not available in advance, the demarcation commission might be empowered to make equitable allocations. An oasis should not be severed from its water

<sup>9</sup> D. Whittlesey: *Trans-Pyrenean Spain: the Vall d'Arán*, *Scott. Geogr. Mag.*, Vol. 49 (1933), pp. 217-28.

supply. There is a possibility in some deserts of increasing the water supply by deep boring or by storage works. It is desirable that a geologist or water-supply engineer accompany both the reconnaissance party and the demarcation commission.

#### FOREST BOUNDARIES

Great forests, like great deserts, may be barriers but not offer naturally-marked sites for boundaries. Mountains and rivers in forests, as in deserts, may be centers of settlement or foci of routes of travel. If the region is inadequately explored, a flexible, though unambiguous, description is desirable, with the delegation of much power to the demarcation commission.

#### RIVER BOUNDARIES

Many rivers have proved troublesome as boundaries. A considerable part of boundary law arises from the behavior of rivers. A river adopted as a boundary certainly should be examined in the field before it is described in a treaty. A river boundary may involve in international action all the complex questions of navigation, bridges, dams, fisheries, power, irrigation, pollution, and water supply. Permanent commissions for administration and arbitration may be needed.

Many rivers are cadastral or property boundaries. If such is the case, the adoption of a river as an international boundary may have some advantages in respect to local government and the operation of farms, mines or other properties. It should not be assumed without knowledge of the stream in question that these advantages outweigh the possible drawbacks.

The reconnaissance of a river under consideration as a boundary should cover the following points: (1) Is the river a suitable line of separation? (2) Is it flowing between rock walls or is it shifting its bed or channel? (3) Is there an obvious main channel? If not, which channel should contain the boundary? (4) Are there islands of undetermined sovereignty? (5) In different portions of the river, what line is most suitable as the boundary? (6) To what stage of water should the description be referred? (7) Will a permanent administration commission be needed?

The possible boundary lines in a river are (1) the middle or median, (2) the channel, (3) the thalweg, (4) a bank, (5) arbitrary lines between turning points. For any of these except arbitrary lines, the stage of water should be specified. The positions of median, channel, and banks, and possibly of the thalweg, may change between low water and flood.

Care should be taken to describe accurately the points at which the boundary reaches and leaves a river. Between these points it may be said to follow the median, channel, thalweg, or other line, or the choice may be left to the demarcators. If "upstream" or "downstream" is used, the direction



in which the boundary is being followed must be kept in mind. It is unwise to use compass directions ("northward along the Blue River," "along the west bank," etc.) because stream courses are never straight and may be incorrectly mapped. "Right" and "left" bank are used as if the observer faced downstream.

#### *River Medians*

The middle or median may be a suitable line in non-navigable portions of rivers. A good definition<sup>10</sup> is: A line every point of which is equidistant from the nearest points on opposite shores at mean water (or other specified stage). The median so defined is unique. If defined as a line joining the midpoints of lines from one shore to the nearest points on the other, the "median" will differ if derived initially from the left or the right bank.

The median of a river should not be confused with the median of the channel.

#### *River Channels*

"Channel" is a vague term: (1) There may be different channels for upstream and downstream navigation and for small and large vessels. (2) The channel may not be a line but a belt of some width. (3) Where there is more than one channel, the "main" or "principal" channel might be the one most used, the deepest, the widest, or the one carrying most water. (4) The channel may change with the stage of water. (Therefore, if a boundary is to follow a river channel, it is important to specify the stage.) The best line to adopt is perhaps "the deepest continuous channel," which is the same as the "thalweg." Do not say "middle (or median) of the deepest continuous channel," for the deepest line is rarely the middle line.

#### *Thalwegs*

The thalweg is usually defined as the line of continuously deepest soundings in a river. (Isolated deep holes are not considered part of the thalweg.) The thalweg, so defined, is not necessarily the same as the channel of navigation and rarely coincides with the median. It is the same as the "deepest continuous channel" and this less technical term might be preferable. It is necessary to make many soundings to locate the thalweg precisely,<sup>11</sup> though it can be determined in a rough way from the current. In rapids, there may be no determinable thalweg. Although the term has a scientific flavor, the

<sup>10</sup> Boggs, *op. cit.*, p. 184.

<sup>11</sup> 2000 soundings were required at one locality on the St. Croix River. International Boundary Commission: Joint Report upon the Survey and Demarcation of the Boundary between United States and Canada from the Source of the St. Croix River to the Atlantic Ocean, Washington, 1934, p. 60.

thalweg may not always be the best boundary. The demarcation commission should have power to deviate from it and to rationalize it into straight segments.

#### *River Banks*

"River bank" is apt to cause trouble in demarcation unless further defined. The stage of water should be stated. In general, river banks are inadvisable as boundaries, as they leave one state with no control over its water margin.

#### *Arbitrary Lines in Rivers*

The "natural" lines in rivers—medians, channels, and thalwegs—have the common disadvantage that they cannot instantly be located with precision. Buoys become displaced. Soundings or measurements take time. Arbitrary straight lines, perhaps approximating one of the natural lines, may be identified by range marks on the land. A river boundary so marked may be located quickly in case of crime or accident. It is wise, therefore, to permit a demarcation commission to substitute straight lines for sinuous river boundaries. Even if the entire boundary is not so rectified, straight segments may be convenient in long reaches.

#### *Changes of Course*

All rivers alter their beds and banks, some rapidly, some very slowly. Three types of behavior should be considered:

(1) Those parts of rivers in which the channel is being cut down rapidly usually flow in narrow valleys or canyons. Such portions may not suffer much lateral change of course. The stream may have many rapids and no continuous channel.

(2) Parts of rivers which swing in meanders usually have main channels and determinable thalwegs but may change course frequently.

(3) Other parts of rivers build up their beds because the stream is there overloaded with sediment. Such portions develop braided courses, often with no persistent main channel. There may be a new channel with every rise of water.

An experienced person often can determine the nature of the different parts of a river from large-scale maps. In default of such maps, reconnaissance is necessary.

Changes of course are said to be either "accretionary" or "avulsive." These terms should be defined in the treaty. The following definitions are suggested: "Accretion" means a change continuous in the space sense. It does not need to be continuous in time. "Slow" and "gradual" are not precise and should be omitted from a definition of accretion. "Avulsion"

means a change discontinuous in the space sense, most frequently resulting from the cutting off of a meander loop.

If shifting rivers are adopted as boundaries, some provision for shifting the boundary must be made. Otherwise the boundary ultimately becomes an imaginary line cutting back and forth across the actual river—a difficult problem for border administration and patrol. A traditional solution is to have the boundary follow only accretionary changes. This doctrine is unsatisfactory in the case of very changeable meandering rivers like the Rio Grande. On that river, it has been decided that the boundary shall follow both avulsive and accretionary changes unless more than 200 persons or 650 acres are involved.<sup>12</sup> (These values are of course not necessarily appropriate to other rivers.) Works to stabilize and perhaps straighten the course should be permitted, and perhaps recommended. Some treaties permit works to return a river to its former bed. Such a right should be subject to a time limit.

Usually a boundary does not shift with changes of course from artificial causes unless there is agreement on a particular case. Artificial changes antedating the adoption of the boundary might be accepted in lieu of the natural channel if the latter cannot be clearly traced or is awkwardly located in relation to the existing course.

#### *Islands in Rivers*

Islands in rivers may cause confusion. Islands may be allocated according to prior ownership, if that is ascertainable. If the thalweg is the boundary, it provides a basis for allocation. A median-line boundary may intersect some islands. The state having the larger part might be assigned the whole island.

Provision must be made for the future ownership of islands if the boundary, following changes of course, shifts from one side to the other, or in case new islands form or old islands are joined to the mainland. A very complete statement, covering nearly all possibilities, is contained in an exchange of notes between Brazil and the United Kingdom over the Brazil-British Guiana boundary, London, October 27 and November 1, 1932.<sup>13</sup>

#### *Bridges and Dams*

Provision may need to be made for marking a boundary on existing or future bridges, dams, or other structures. It is advisable for the boundary to pass through an arch rather than a pier of a bridge. It is also advisable for the boundary on the bridge to be approximately over the line in the water.

<sup>12</sup> Treaty of March 20, 1905, U. S. Treaty Series No. 461, Washington, 1907.

<sup>13</sup> League of Nations Treaty Series, Vol. 177 (1937), pp. 128-9.

It is convenient for the boundary to cross a bridge or dam approximately perpendicular to the long dimension. If reasonable harmony exists, the determination of the boundary on existing structures may be left to the demarcation commission. The boundary on future structures may be subject to agreement or left to a permanent administration commission.

#### *Sources and Mouths of Rivers*

"Source" and "mouth" are vague terms and should not be used without amplification. It is better to name and locate a particular point if adequate information is available.

It is often difficult or impossible to find an exact source or even a "principal source" of a river. A river may have many small tributaries of approximately equal length. If an unmistakable point cannot be selected on the basis of available information, it is wise to specify only "a convenient point near the source of Rock Creek, to be chosen by the demarcation commission." It is very unwise to refer to the "source" of a major river receiving water from widespread tributaries.

The "mouth" of a river might be the head of an estuary, the opening of the river into a bay, or the opening of the estuary or bay into the sea. In a delta, a river usually has several mouths and perhaps no "principal mouth," and may open new mouths and abandon old ones. Adequate knowledge of the river in question obviously is important. If such knowledge is unobtainable, it is wise to specify only "a convenient point near the mouth of Black River, to be chosen by the demarcation commission."

#### *River Crossings*

Few documents specify how a boundary crosses a river. Demarcators should be able to agree upon this matter, and it is perhaps best left to their discretion. If a river crossing is to be described in a document, geometrical terms like "axis" and "perpendicular" should be avoided. The possible existence of islands requiring allocation should be considered.

#### BOUNDARIES IN SWAMPS AND MARSHES

Swamps and marshes, like deserts and forests, may be barriers but not offer naturally-marked sites for boundaries. Channels may exist, but may be tortuous and discontinuous. The topography of the swamp may vary with the stage of water. In one case<sup>14</sup> it was decided to adopt straight lines between monuments set on whatever firm ground was available. Since swamp land is ordinarily of low value, much leeway can usually be given to the demarcators.

<sup>14</sup> J. B. Laws: A Minor Adjustment in the Boundary Between Tanganyika and Ruanda, *Geogr. Journ.*, Vol. 80 (1932), pp. 244-7.

## BOUNDARIES IN LAKES

A boundary along a shallow lake might follow the middle of the navigable channel, if one exists. In deep lakes or shallow lakes without navigable channels, a median may be defined as for a river (above).

An arbitrary boundary in a lake can be described by turning points or by courses and distances. If both methods are used, one should be stated to rule, as it is probable that slight discrepancies will exist. Location of turning points is the better, as there is no accumulated error. These methods should not be used unless the lake is accurately mapped. The choice of line in a poorly-mapped lake should be left to the demarcation commission.

In describing boundaries in lakes, geometrical terms like "parallel" or "perpendicular" (to a shore or the "axis" of the lake) should be avoided.

Unless it is known that the lake undergoes no significant changes of level, it is wise to specify the water stage to which the description applies. If the boundary follows the bank of the lake (generally not a satisfactory arrangement), it is especially important to give the stage. Dams or other structures which raise or lower the lake level may change the banks and median. Generally, the boundary should not change in such cases unless by special agreement.

Artificial changes antedating the adoption of the boundary might be accepted in lieu of the natural median or bank if the natural line cannot be relocated.

The terms "inlet" and "outlet" should be avoided. A lake may have more than one of each or may have no inlet or outlet. If a particular point cannot be described by name, bearings, or coordinates, it is wise to specify only "a convenient point near the place at which Black River enters (or leaves) White Lake, to be chosen by the demarcation commission."

Such terms as "northern end" or "northwesternmost point" of a lake should be avoided. If an accurate map is available, an exact point should be named (if a name exists) and located by coordinates or bearings.

It is unwise to state that the boundary shall "divide the waters equally." Any number of lines can be drawn dividing the waters equally, while the median, as defined here, may not. Exact equality in division of the lake surface is usually not necessary.

## BOUNDARIES IN BAYS AND STRAITS

There is no accepted quantitative definition for "bay" or "strait." Certainly a channel or inlet less than six nautical miles across would not be "high seas." There is some agreement on ten miles as a limiting width, but there are cases in which even wider channels have been considered territorial waters.

In describing a boundary through a bay or strait of considerable width (say, six miles or more), it is desirable to state whether it is a true international boundary (thus making the waters territorial) or simply a "line of allocation" for assigning ownership of land areas. Misunderstandings have arisen over this point. On the map, different symbols should be used for true boundaries and lines of allocation.

In bays or straits, boundaries may be navigable channels (if such exist), medians (defined as before), or arbitrary lines. Description might be by turning points or by courses and distances. If both are stated, one (preferably the turning points) should rule.

#### BOUNDARIES THROUGH THE MARGINAL SEA

If the boundary reaches a seacoast, it should if possible be continued through the marginal (territorial) sea. A method for determining boundaries in the marginal sea has been described by Boggs.<sup>15</sup> In some cases, however, it may be necessary to adopt customary boundaries, arbitrary lines, or the seaward extension of the last land segment. Terms like "parallel" or "perpendicular" to a coastline should be avoided. Accurate maps are indispensable.

"Coast" and "shore" should be avoided in boundary documents. "Coast" may connote both shore and hinterland (e.g., "Gold Coast"). "Shore" refers to the belt within tide range. "Coastline" and "shoreline" may be used informally but are not precise. A tide stage should be given, such as "mean high water mark." It may also be advisable to define "island" in relation to tide stage.

#### LINES OF ALLOCATION

Lines of allocation are delimited through the high seas or unexplored areas for the purpose of allocating lands without conveying ownership of the high seas. They may be unofficial (as drawn by atlas makers) or official. The simplest description for lines of allocation in the open ocean is by meridians and parallels, employing no diagonal lines. In constricted waters, diagonals may be necessary. It is best to describe the turning points exactly (by latitude and longitude) and state the courses or bearings approximately, rather than *vice versa*.

If lines of allocation are drawn on navigational charts on the Mercator projection it should be remembered that straight lines (other than the equator and the meridians) on such charts are not straight lines on the earth.

<sup>15</sup> *Op. cit.*, pp. 184-192.



Since many parts of the world are imperfectly charted, with mislocated and perhaps undiscovered islands, provision should be made for error. A rather complete treatment of this problem was made in the convention between the United Kingdom and the United States, allocating islands between North Borneo and the Philippine Commonwealth.<sup>16</sup>

Different symbols should be employed on maps to distinguish lines of allocation from true boundaries.

#### GEOMETRICAL BOUNDARIES

Apparently the simplest of boundaries, geometrical lines may prove difficult to describe precisely. The major difficulties arise from the fact that the earth is neither flat like a map nor perfectly spherical like a globe. Geometrical lines on flat maps may have very different properties from lines through corresponding points on the earth. These differences arise from the projection of a curved surface onto a plane. Great errors can arise if geometrical lines are drawn on projections the properties of which are not thoroughly understood. No long geometrical boundary should be described without the advice of a geodesist. The geodetic "datum" or basis of reckoning should be given (e.g., "North American datum of 1927") and it is well to state that the boundary upon acceptance stands as surveyed even though subsequent geodetic work permits more accurate demarcation.

#### *Meridians of Longitude*

A meridian boundary may be described as "a line due north (or south) from the point M," or as "the meridian north (or south) from point A," or as "the meridian of XX degrees, XX minutes, XX seconds, west (or east) of Greenwich." The reference to Greenwich should not be omitted, for other prime meridians are still sometimes used. Do not call the meridian of ten degrees (for example) the "tenth meridian" in formal documents.

#### *Parallels of Latitude*

There are three kinds of latitude: Astronomic, geodetic, and geocentric. A geodesist should be consulted as to which to adopt in a given case. Geodetic latitude is probably best for boundaries if data permit. Otherwise, astronomic latitude should be used. It should be permissible to substitute a mean astronomic parallel if, in mountains, gravity effects make the astronomic parallel very sinuous.

A parallel might be described as "the parallel of XX degrees, XX minutes, XX seconds, north (or south) latitude" or as "the parallel east (or west) from Point A." It is unwise to describe a parallel as "a line due

<sup>16</sup> U. S. Treaty Series No. 856, Washington, 1933.

east (or west)" from a point. Such a description might suggest a straight line (parallels are curved) of due east initial direction. "Due east along the parallel" would, however, be permissible. It is convenient to convert parallels into a series of short straight segments (chords). In middle latitudes, one-mile chords introduce no significant error. In sparsely-populated areas or in low latitudes, twenty-five-mile chords might be permissible.

In formal documents, avoid the use of "the tenth (or other) parallel" for "the parallel of ten degrees."

#### STRAIGHT-LINE BOUNDARIES

A "straight line" on the earth is really an arc of a great circle.<sup>17</sup> (For short segments, between intervisible turning points, the line of sight is a straight line.) Such a boundary may be described as "a straight line between Points A and B" or by means of the bearing of B from A. (Bearings may be given either in degrees of the whole circle clockwise from north, or by quadrant, in the form "North forty-five degrees west." The latter method is somewhat less subject to misinterpretation, though the former is increasingly used in engineering and navigation.) It is sufficient to describe the turning points and not give the bearing. If both are given, the turning point locations should rule.

It is important to note that lines of constant direction (ship's courses, straight lines on Mercator charts) are not great circle arcs and therefore not "straight lines," unless the direction is due north or south along a meridian or due east and west along the equator. On a long segment, the difference between the "straight" great circle arc and the curved line of constant direction may amount to many feet or miles. Maps on the gnomonic projection show all great circle arcs as straight lines.

Such terms as "westward" and "westerly" should be avoided.<sup>18</sup> (Also, "northwestward," etc.) Use either "due west" or "in a general westerly direction," whichever is meant.

#### CIRCULAR BOUNDARIES

Arcs of small circles have been adopted for boundaries, but are not recommended. They are hard to demarcate except as a series of chords. The center must be precisely described. "A ten-mile circle about Newtown" is inexact, since the center in "Newtown" is not specified. As an alternative, it is suggested that a number of turning points be selected approximately ten miles from "Newtown," and that the demarcators be empowered to choose the lines between them.

<sup>17</sup> Practically, but not strictly, as the earth is not a perfect sphere.

<sup>18</sup> Holdich, *op. cit.*, p. 195.

## EQUIDISTANT LINES

Boundaries should not be described as lines equidistant from, or parallel to, a river, shore, railway, or other reference line. "Equidistant" is ambiguous. Does it mean that the reference line is to be transposed, in all its sinuosity, a certain distance? Or should arcs be swung from the reference line, and the resulting awkward series of curves be demarcated? Such descriptions as "ten miles from Crooked River"<sup>19</sup> or "sixty miles inland" should be avoided.

As an alternative, it is suggested that a number of turning points be selected approximately the desired distance from the reference line, the demarcators being empowered to complete the boundary.

It should be noted that a line equidistant from (or parallel to) a meridian is not another meridian, due to the poleward convergence.

## BOUNDARIES RELATED TO HUMAN FEATURES

Unless described astronomically or in principle, boundaries of this type must be described in terms of material features, natural or artificial, or by geometrical segments related to such features. Therefore the suggestions and warnings of the preceding pages are applicable. In general, where human features are especially significant, it is important to have up-to-date information on the area in question and best to give considerable freedom to the demarcators. In evaluating maps of human features, it should be remembered that (1) language and nationality are not synonymous, especially in detail; (2) maps rarely give true pictures of the dovetailing of languages or of nationalities in borderlands; (3) census data seldom are strictly comparable in two countries, due to different dates, different criteria, and different standards of accuracy.

If a boundary is described by reference to towns or villages, certain precautions must be observed: (1) The place name alone is insufficient, because it may refer to a township, county, or region as well as to the central settlement. It should be preceded by a phrase such as "town of." (2) A settlement has area. If possible, a precise point in the settlement should be described. "Center" is ambiguous. Settlements are irregular in shape, with straggling dwellings at the edges. (3) Native villages are easily moved and may be far from the location shown on the map. Native place names often have been transcribed erroneously.

## PRE-EXISTING BOUNDARIES

Pre-existing international, communal, or property (cadastral) bounda-

<sup>19</sup> Cf. Clifford, *op. cit.*, on the boundaries of Gambia, pp. 370-1.

ries may be adopted and described in treaties. At least in the case of property lines it is well to give the demarcators considerable freedom, for the pattern may be very irregular or poorly adapted to communication or landforms. In many parts of the world, scattered holdings of a single farmer or landlord are the rule.

As careful thought should be given to the description of a pre-existing boundary as is given to the description of a new one. It is wise to examine the boundary in the field before it is described, as it may prove to contain awkward salients or enclaves or be unsuitable for present conditions. Also, monuments may be missing or misplaced. If the pre-existing boundaries are well marked or have been well described in records, it may suffice to refer to "the boundary between A and B as of January 1, 1888" or "as described in the treaty of Centropolis of January 1, 1888."

#### TRIPLE POINTS

Unless a boundary ends at the high seas, it terminates at a point where the territories of three or more states meet. Since the usual boundary treaty is bilateral, it may take three treaties to fix a triple point. Major problems may arise when two countries demarcate their common boundary before they have completed their boundary treaties with the third. The demarcators may trespass on territory claimed or occupied by the third country, or an undemarcated gap may be left. The problems of triple points may often be anticipated by study of prior documents and by making provision for adjustment to future treaties with the third country.<sup>20</sup>

#### CONCLUSION

This paper has presented suggestions for clarifying the description of international boundaries in formal documents. These suggestions are not meant to be rules. A boundary is an earth feature, and its description must fit that fact, not a formula.

Because of the infinite number of combinations of natural and human features on the earth, no two boundary sites are exactly alike. Because of this variety, field knowledge of a given site is of great value in boundary description. Too much faith should not be placed in maps. General acquaintance with the border area may be insufficient. If the describer can

<sup>20</sup> Some triple point problems are discussed in the following:

Boggs, *op. cit.*, pp. 80-5.

E. H. M. Clifford: The British Somaliland-Ethiopia Boundary, *Geogr. Journ.*, Vol. 87 (1936), pp. 294-5.

D. Cree: Yugoslav-Hungarian Boundary Commission, *Geogr. Journ.*, Vol. 65 (1925), pp. 107-8.

visualize, from first-hand knowledge, each major turning point and segment, the chance of error is greatly reduced.

No map can be a replica of the earth and no text can reproduce the earth in words. Language contains an inherent element of vagueness and ambiguity. No dictionary can define with absolute precision such terms as "foothill," "source," and "channel." A boundary treaty should itself define such terms as it employs. Boundary surveying is more precise than boundary description. A treaty should recognize this fact by permitting the demarcators to make adjustments, in a clause clearly stating powers and procedures.

In the whole process of boundary-making and boundary administration, intangible factors such as nationality may be more important than material features, even in sparsely-populated lands. For the limited purpose of boundary description, material features, whether natural or of human construction, are convenient reference marks, but convenience of description should not be the criterion of a boundary. Description is not an end in itself. A bad boundary can be described well but be no better for that fact. But a good boundary well-described is better than the same boundary poorly-described. The less friction in boundary-making the better, and workman-like description can reduce that friction.

In concluding, the writer confesses his fear that, being human, he has left vaguenesses and ambiguities in this critique of vagueness and ambiguity. If so, he requests that they be called to his attention.

*University of Hawaii*

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# The Political Significance of Tropical Vegetable Fats for the Industrial Countries of Europe

LEO WAIBEL\*

In the first decades of the nineteenth century a decided change occurred in the economic structure of central and western Europe. The continent had just recovered from the Napoleonic Wars; the industrial revolution was spreading from England to the continent and the population of western and central Europe was rapidly increasing. With industrialization there also came from England the system of crop rotation which destroyed the old three-field economy and made possible the cultivation of potatoes on the formerly fallow lands. By this means starch flour became an important constituent in the diet. However, there soon appeared an acute shortage of animal fats, especially since the animal fats of the Arctic, particularly whale oil, were quickly depleted.

Under these circumstances it was natural that industrial Europe should turn more and more to reliance upon the abundant and cheap vegetable fats and oils of the tropics. Each of the three tropical regions has its own indigenous fat plant, as it has also its characteristic cereal and luxury plant. In tropical Asia the coconut palm is the most important fat plant, and in tropical Africa the oil palm (*Elaeis guineensis*). The outstanding producer of fat native to tropical America is not a palm but an annual plant, the peanut (*Arachis hypogaea*).

Tropical America has never played an important world rôle in the production of fats for export. The American peanut is not grown in America for the European market but in Africa and Asia. This fact has nothing to do with the soil or climate but is historically induced. In tropical America the Europeans with the help of Negro slaves had established the plantation industry which, because of great expenditure of labor and capital, was profitable only if products of high value were cultivated. Under these conditions the commercial cultivation of the peanut did not pay.

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\* Dr. Leo Waibel, formerly professor of geography at the universities of Kiel and Bonn, is now visiting professor at the University of Wisconsin. He is widely known for his studies of problems in tropical geography and the sources of tropical raw materials. Investigations in these fields have taken him into both the African and American tropics. The present article draws significant conclusions from facts in the history of the tropical vegetable oil trade.



In tropical Asia the natives produced the commodities which the Europeans desired. But this tropical region was very remote from Europe, and, because of the existing transportation methods, the easily perishable vegetable oils spoiled on their long route. Even more important was the fact that, at that time, oil seeds from British India had to cross the equatorial belt of calms twice on their way to Europe around Cape Good Hope.

#### TROPICAL WEST AFRICA

The situation was quite different in tropical West Africa, especially in Senegal, Gambia and the Upper Guinea Coast which lie to the north of the equator closer to Europe than any other region of the tropics. Advantage of location was then a primary reason why here, for the first time in the history of the tropics, vegetable fats were produced in large quantities for the European market and why the political interests of European industrial countries were centered in this region.

During the entire colonial period West Africa had provided laborers for the plantations of the New World. Europeans had established fortified trading posts along the entire upper and lower Guinea Coasts, but their political influence extended no farther than the range of their cannon. Under these circumstances normal trade was impossible.

Abolition of the slave trade and of slavery in the first decades of the nineteenth century was a deadly blow to the American plantations, and then an attempt was made to introduce the "American principle" of plantation economy into West Africa. The British colony, Sierra Leone, was established in 1790 to produce in Africa with free labor the tropical products which until then had been grown in tropical America with African slaves. This attempt, like a similar one which the French undertook in Senegal in the 1820's, was a complete failure. The Negroes, who under compulsion had done satisfactory work on the American plantations, refused to work for the European planter in Africa. If tropical Africa were to supply the European market with tropical products, then the "Asiatic principle" of commercial native culture had to be adopted. Under this system the natives could bring their surplus products to the market and the Europeans could take charge of trade and transportation to Europe. The rights of the old trading companies—a relic of the slave trade period—were now abolished, and France as well as England assumed the administration of these regions.

From the beginning, the French and the British had definite spheres of interest. The French were concentrated in the Sudan, that zone of grasslands and thorn forests which extends between the Sahara on the north and the evergreen hardwood forest on the south. The open character of the

landscape as well as the two rivers, which open the Sudan in a west-east direction (Senegal and Niger), led the French easily into the interior. Both rivers are navigable for great distances, the Senegal in its lower course and the Niger in its upper course. It is true that the French established strongholds on the Upper Guinea Coast at the same time: 1842 on the Ivory Coast and 1850 in Dahomey. However, these regions were not economically exploited until many decades later.

The English, on the other hand, concentrated on the Upper Guinea Coast where they had already selected the best locations; the Gold Coast in 1665 and Sierra Leone in 1790. This region is densely forested and not easily accessible. From the coast the English penetrated into the interior, and here the navigable lower course of the Niger played an important rôle.

The areal division of West Africa into a French Sudan sphere and a British Upper Guinea Coast sphere is explained, in my opinion, above all by the needs of the two countries for different fats. France alone of all European industrial countries has an old vegetable fat industry which is based on the olive. Consequently, she was interested in a vegetable fat which could be utilized in its natural form in the soap and edible oil industry of Marseilles. For this purpose the peanut was excellently adapted, because peanut oil when cold-pressed is edible without refining. This is the reason why France has been unique in regard to the use of peanut oil. In Africa, the peanut is cultivated on a large scale only in the steppes and thorn forests of the Sudan, the sphere of French influence.

England, on the other hand, was interested at that time in a cheap vegetable fat which could be used in the soap and candle industry. For this the palm oil was especially well suited. The oil palm is indigenous not to the steppes of the Sudan but to the forests of the Guinea Coast, the sphere of British influence, and to the Congo Basin.

There is still another difference between the oil palm and the peanut. The former, being an indigenous plant of West Africa, grows wild exuberantly in the evergreen hardwood forests. The natives use the oil of the fruit pulp of the wild as well as of the cultivated palms for food. Palm oil is consequently inexpensive and obtainable in unlimited quantities provided there is adequate transportation.

#### *The Peanut Industry*

The peanut, on the contrary, is a foreign plant and must therefore be cultivated. As a rule the cultivation of introduced plants for foreign markets requires a high degree of knowledge, and one wonders why the Negroes of Senegal and Gambia were capable of growing the American plant for the world market. The question is answered if one realizes that the peanut originally was raised in tropical America according to the method of shift-

ing cultivation and that this same method is practiced by the Sudan Negroes. This system of agriculture allows only three or four successive crops from the same field, then the fields are abandoned and new land is cleared. This primitive method explains why peanut cultivation shifted first, from Saint Louis along the coast southward to Dakar, and later on, after 1907, along the railway line from Dakar to Kayes, inland and eastward.

It has been estimated that 70,000 acres of land yearly are cleared in the interior while, at the same time, 70,000 acres are abandoned farther west.<sup>1</sup> Like a huge steam-roller, peanut cultivation moves inland, destroys thorn forests, creates life for a few years, and leaves behind a devastated area, a man-made desert. It is to be expected, therefore, that peanut cultivation in Senegal and Gambia must decrease rapidly, sooner or later, if the Negroes do not learn to apply a more intensive system of cropping and to change from shifting cultivation to a permanent type of agriculture.

Until now, however, there has been no decrease in production. Peanuts were first shipped from Senegal to France in 1840; since that time their export has greatly increased in quantity as well as in value. In 1938 the amount shipped was 546,000 metric tons, which constituted about 80 per cent of the total value of exports of the Senegal colony.

Of relatively greater importance is the cultivation of peanuts in the neighboring British colony, Gambia. Here, as early as 1858, peanuts constituted 83 per cent of the total export value, and subsequently the rate has increased almost to 100 per cent. In quantity the export of Gambia is, however, much smaller than that of Senegal (51,000 tons in 1939). A large portion of the peanuts exported from Gambia comes across the frontier from the neighboring French territory and is shipped to France.

Because they are a bulky and heavy commodity, peanuts can be shipped only from areas which are opened either by river navigation or railways. Therefore, in addition to Senegal and Gambia, only Northern Nigeria is able to export peanuts in large quantities. However, here the peanut is not exclusively a commercial crop, as it is in Senegal, but also a subsistence crop. Furthermore, this region is located 700 miles from the coast. This means that transport costs are considerable, and peanuts can be exported only when prices are high. The result is that exports are fluctuating and vary considerably from year to year. In 1938, 147,000 tons were exported, which constituted 12 per cent of the total value of Nigerian exports.

In 1933, the Sudan as a whole exported 662,000 tons of peanuts; of which 52 per cent went to France, 22 per cent to Germany, 9 per cent to

<sup>1</sup> Leo Waibel: *Die Rohstoffgebiete des tropischen Afrika*, Leipzig, 1937, p. 284.

Great Britain and 7 per cent to the Netherlands; that is to the principal industrial countries of Europe.

#### *The Oil Palm Industry*

A belt of oil palms, 60 to 80 miles wide, extends along the Upper Guinea Coast from Portuguese Guinea on the west to the Cameroons on the east. The total number of oil palms in this area may well exceed three to four hundred million. These trees are seldom found in the dense primeval forest but thrive best along the edges of the forest and on former man-made clearings.

The fruit of the oil palm looks like a plum; the seed, called kernel, is surrounded by a fleshy pulp. The pulp as well as the kernel contains about 40 to 50 per cent oil. The oil which is produced from the fruit pulp is called palm oil. It is easily manufactured by pressing and is edible in its natural form. Natives use it for various food purposes. If it is stored for a while, it becomes rancid but is still useable in the manufacture of soap and candles. Palm oil is heavy and bulky, and the main problem in its production for the world market is its transportation from the interior of the country to the coast. This is the reason why palm oil was largely exported from the Niger Delta with its numerous distributaries.

Palm oil was sent for the first time to England in 1810. Then the abolition of slave trade freed the labor forces and capital for palm oil trade, and, as early as 1830, 2,000 tons were shipped to England. The industry, however, did not become of real importance until the 1850's. The outbreak of the Crimean War in 1853 had resulted in a sharp decline in the export of fat and tallow from the Black Sea region. Then Great Britain became earnestly interested in the palm oil coast. In 1861 the chieftain of Lagos, on the Niger Delta, was deposed and his kingdom was declared a British protectorate. In addition to Nigeria, the Gold Coast and Sierra Leone soon became the most important export region of palm oil, and Liverpool and Hull were developed as important oil manufacturing centers.

However, England was not the only European industrial country which changed from animal to vegetable fat and consequently became interested in tropical vegetable fats. This same phenomenon occurred in the two new and growing industrial countries, Germany and Belgium. Both countries, likewise, became interested in the tropical region which was located nearest to them—West Africa.

Germany, the more populous of the two countries, had a great demand for fat, and she became interested in West Africa much earlier than Belgium. About the middle of the last century Germany still was not a political unit,

and the overseas interests of the German Federation were represented by the Hanseatic merchants.

In 1847 the Carl Woermann firm in Hamburg sent ships for the first time at irregular intervals to West Africa, and in the following years established factories in Liberia (1850), Gabun (1855) and Duala in the Cameroons (1868). In 1856 the firm of F. M. Vietor in Bremen established factories on the coast of Togoland, and, at about the same time, several other German firms founded large factories in Lagos. The German trade ranked second only to that of Great Britain along the entire west coast of tropical Africa. Even in the shipping business the Germans were attaining an ever increasing importance. In 1870, 30 ships from West Africa arrived at Hamburg; by 1882 the number had increased to 96. In the latter year, two years before the German Empire acquired the colonies of Togoland and the Cameroons, the Carl Woermann firm organized regular shipping services between Hamburg and the Guinea Coast. Palm oil was the product which stimulated and dominated the entire trade. This fact one must know and bear in mind if he is to understand the desire of the German Empire for colonial possessions. The former German colonies, Togoland and the Cameroons, had their origin in the factories of the Hanseatic merchants on the palm oil coast. The growing demand for vegetable fats induced the German Empire, established in 1871, to acquire tropical colonies.<sup>2</sup>

I do not dare maintain that the same was true of Belgium. There were doubtless many reasons which led King Leopold II of Belgium to the establishment of the Congo Free State in 1884. But there is one fact which should not be overlooked. The first exports of the Congo Free State were not ivory or rubber but palm oil and palm kernel; they constituted, in 1890, 50 to 60 per cent of the total value of exports from the area. Later rubber became the most important product, due to an enormous increase in its price. However, today, palm oil and palm kernel are again the most important non-metallic exports of the Congo.

In the meantime an important change took place in the oil palm industry of West Africa. Since the 1870's the price of palm oil on the world market had been continually decreasing, chiefly because of new competitive raw materials for the manufacture of soaps and candles, or of substitutes. Of the new raw materials the most important was petroleum introduced as an illuminating material. The result of this change was that the palm oil export of West Africa about 1900 was more or less the same as it was around 1870.

Now the Europeans and especially the Germans were beginning to be interested in the palm kernels for which the natives had no use and which

<sup>2</sup> Leo Waibel: *l. c.*, p. 106.

they threw into rivers as worthless. Thanks to the stimulation of the German Economic Colonial Committee (Kolonialwirtschaftliches Kommité), which was a counterpart to the British Empire Cotton Growing Corporation, special equipment was manufactured to crack the kernel and press the oil. Furthermore, the chemical industry developed new methods to refine and deodorize the palm kernel oil and to make it edible in the form of margarine. Now large oil factories were established in Hamburg, and the residue from the oil presses was used as feed. As a matter of fact, the dairy industry of northwestern Germany is based to a large degree on the tropical oil cakes. Even after the first World War, when Germany had lost her colonies, she remained the most important buyer of palm kernels.

Great Britain and Belgium, whose dairy industries were relatively less important, established oil factories in their West African colonies. Today they export palm oil as well as palm kernel oil and palm kernels. The palm oil industry of the Belgian Congo is almost entirely in the hands of a large British soap company, the Lever Brothers in Liverpool.

So we see that the political partition of West Africa and the present economic situation of this region has an important relation to the demands for vegetable fats by the European industrial countries.

#### TROPICAL ASIA

In tropical Asia the vegetable fats were likewise important. Here the opening of the Suez Canal in 1869 played an important rôle. Formerly, as I have already mentioned, the easily perishable vegetable fats of British India had twice to cross the equatorial belt of calms on their way to Europe. The result was that the cargo was often entirely spoiled and was declared worthless at its port of destination. With the opening of the Suez Canal not only was the distance between British India and Europe greatly shortened, but, even more important, the ships remained north of the equator during the entire voyage. India now received a geographical location similar to that of Senegal, and she immediately began to export oil seeds.

#### *The Peanut Industry*

Of the various annual fat plants of British India the American peanut became the most important. While the cultivated area of peanuts in British India amounted to only 100,000 acres in the 1870's, today it amounts to 8 million acres. The areas producing for foreign markets are found chiefly in the hinterlands of the ports, Bombay and Madras. In the Madras Presidency the main region of cultivation is found in a wide arc around the French port city of Pondicherry. As a matter of fact, the trade connections between



Pondicherry and Marseilles were the cause of the extensive peanut cultivation in this part of India.

In British India peanuts are intensively cultivated in a complicated rotation system; yields, consequently, are considerably higher than in West Africa. However, peanuts are not raised exclusively as a commercial crop, as they are in Senegal, but are also grown for home consumption. But if each of the many hundred thousand farmers produces only a small surplus, a large quantity is available for exportation. This is the reason why British India has far outranked West Africa. In 1938 British India exported 900,000 tons of peanuts which constituted 6 per cent of the value of all exports.

#### *The Coconut Palm Industry*

On all the islands of tropical Asia and Oceania the coconut palm grows either wild or receives but little systematic cultivation. Here it plays the same rôle as the oil palm does in West Africa and provides a cheap oil which is used in the candle, soap and margarine industries. As with the oil palm, the oil was the first product to be exported. In the 1860's, however, the so-called copra process was discovered, which consists of a more or less careful natural and artificial drying of the meat of the fruit. In addition to the opening of the Suez Canal, a further event of 1869 had a great influence on the Asiatic coconut palm industry. In this year a French chemist received a patent for the manufacture of margarine, and it was later found that coconut oil could easily be used in the manufacture of this substitute for butter. Copra now became an important product of the world market, and the interests of the European industrial countries shifted to the tropical region of Asia, as they had thirty years earlier concentrated in West Africa.

Here again Germany became a competitor to the old colonial powers, England, France and the Netherlands. A few years after the opening of the Suez Canal, firms in Hamburg established factories in that region of the East where the other powers previously had no interest, that is, the remote Pacific area. The Hamburg firms Godeffroy (1873) and Hernalshausen (1879) organized the copra trade of the Pacific and founded factories in New Guinea, New Britain, New Ireland, Bougainville and in the western Samoan Islands. On the latter the firm Godeffroy had established the first coconut plantation of the Pacific in 1877.

Under the pressure of these influential firms their settlements in New Guinea, New Britain, New Ireland, western Solomon and Marshall Islands were declared German protectorates in 1884. An expansion of the German colonial possessions brought 15 years later the disintegration of the Spanish

colonial empire. Now another inheritance of the firm Godeffroy was placed under German domination, namely the western Samoan Islands, and Germany bought from Spain, for four million dollars, the Caroline and Marianne Islands with their abundance of coconut palms. This fact confirms my above-mentioned thesis, that the fat demand of the German Empire essentially led her into a colonial policy. Germany had only economic rather than strategic or military interests in the Pacific. She had no continental Pacific base and constituted no serious threat to the other Pacific powers. Her main aim was to get copra, and she continued to be the most important consumer of copra even after she had lost her Pacific colonies.

Germany, as well as Great Britain, France and Holland, used every possible device to enlarge the trade connections between the Asiatic and Pacific colonies and the home country. As a result, much of the copra trade had a definitely national character. The shipping routes important in this trade were operated with the aid of government subsidies. Everywhere in Europe copra was given preference to coconut oil by being admitted without duty, so that the residual cake could be used in European agriculture. The establishment of oil mills in Europe also served as a means of additional employment of European labor.

#### *The Palm Oil Industry*

During the first World War the high price of palm oil and palm kernel oil induced the planters of the east coast of Sumatra to cultivate the African oil palm (*Elaeis*). After the war, German botanists and planters, who had experience in the oil palm industry of West Africa, contributed largely to the great success of the new industry in tropical Asia. I do not know to what degree, if at all, German capital has been invested there to make up for the loss of the West African colonies.

The African oil palm thrives extremely well on the east coast of Sumatra. The annual increase in height is greater than it is in West Africa, the time from germination to fruit bearing is shortened by four years, and yields are much higher. The fruits contain more pulp and less kernels than those of West Africa.<sup>3</sup>

Furthermore, in tropical Asia the oil palm is raised not by natives but by Europeans on large plantations. This means that the selection of seed and the application of fertilizer play an important rôle in cultivation, while oil from the pulp as well as from the kernels is carefully processed in modern mills. The result is a product with a high content of oil and a low content of fatty acid; consequently it yields a much higher price than that produced by the natives of West Africa.

<sup>3</sup> E. Fickenday: *Die Oelpalme an der Ostküste von Sumatra*. Berlin, 1922, pp. 3-4.

Oil palm plantations were first established on the east coast of Sumatra in 1917, and in 1924 plantations were laid out in British Malaya (Lower Perak and Kuala Selangor). These plantations soon became a serious competitor to the native farmers of West Africa, as far as oil production is concerned. This is clearly indicated by the following figures on the export of palm oil:

	1928	1933	1938
Total, in metric tons ....	218,000	342,000	497,600
Share of West Africa ....	86.2 per cent	62.5 per cent	44.5 per cent
Netherland's Indies ....	13.2 " "	33.9 " "	44.4 " "
British Malaya .....	0.6 " "	3.6 " "	11.1 " "

Regarding export of palm kernels, however, Africa's position has only slightly decreased.

	1928	1933	1938
Total, in metric tons ....	536,000	557,500	696,500
Share of West Africa ....	98.9 per cent	95.4 per cent	92.0 per cent
Netherland's Indies ....	1.0 " "	4.1 " "	6.8 " "
British Malaya .....	0.1 " "	0.5 " "	1.2 " "

#### THE SIGNIFICANCE OF TROPICAL FATS FOR GERMANY

Toward the end of the 19th century, Great Britain had by far the largest trade of any European country in foreign oilseeds and nuts and was the principal user of imported vegetable oil materials. In the first years of the 20th century, however, Germany became a keener and stronger competitor, and shortly before the first World War she far outstripped Great Britain in her use of coconut and palm kernel oil. Indeed the British trade was becoming seriously concerned over loss of business.<sup>4</sup>

The experiences of the first World War have shown to what a degree the German economy had become dependent on the import of tropical vegetable fats. The scarcity of vegetable fats was not the only evil. The lack of oil cakes led to a scarcity of feed, and this, in turn, resulted in the decline in the number of beef cattle and swine and in a scarcity of meat and animal fat. And this was not all. The lack of concentrated feeding stuffs reduced the volume and the fertilizing value of manure, which in turn, resulted in smaller yields of cereals, roots and other crops.<sup>5</sup> The population became undernourished, many diseases due to faulty metabolism occurred, and the moral and physical power of resistance of the German people was weakened.

<sup>4</sup> Carl L. Alsberg: *Fats and Oils Studies*. No. 1. Food Research Institute. Stanford, California, 1928, p. 94.

<sup>5</sup> *Ibid.*, p. 100.

In the present war almost the entire European continent is cut off from tropical vegetable fats. But this time Germany has learned from the experiences of the former war. It is my personal conviction that Hitler attacked Russia at the moment when he recognized that the war would be a long one and that he must make secure the food supply of the German people. That is one of the reasons why he occupied the South Russian steppes with their rich supply of linseed, sun flower seed, wheat, cattle and sheep. If he should succeed in rebuilding the destroyed agricultural economy of this region, he would have made good the absence of tropical vegetable fats and could endure a long war.

*University of Wisconsin, Madison*

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## The Seasons' Arrivals and Lengths

STEPHEN S. VISHER

Hartshorne<sup>1</sup> has called attention to the fact that about half of the United States limits. These are (1) winter, cold, below 32° F.; (2, 3) spring and fall, cool, 32°–50°; (4, 5) early and late summer, warm, 50°–68°; and (6) summer, hot, over 68°. He gave, for two American and for several foreign cities, diagrams which show the approximate dates and hence duration of the seasons, and a world map of the types and number of seasons.

Here are given, for the United States, maps showing the approximate dates of the usual commencement of these seasons, and the average duration of each. They are based on the 46-year normals of daily temperature (average of day and night) at 160 well-distributed Weather Bureau stations.<sup>2</sup>

Because of the significance of exceptionally hot and exceptionally cold weather, the periods with daily normals below 20° and above 75° are also given. They are here called respectively "cold winter" and "hot summer."

Maps 1–4 show the dates (according to the limits here used) of the commencement of spring, early or fore-summer, summer, and hot summer. Since much of the South and a Pacific coastal belt have no daily normals below 32°, and hence no winter, the arrival of spring is shown only for the rest of the country. It comes (Fig. 1) about February 1 along a line extending from New Jersey to northern Texas. Spring comes two months later in the northern parts of Michigan, Wisconsin and Minnesota. Warm weather (a daily mean of 50°) or fore-summer comes about February 1 near the Gulf (Fig. 2), about April 1 approximately midway between north and south, but about May 1 in a northern zone extending from Massachusetts to South Dakota.

Summer (daily means above 68°) comes before May 1 near the Gulf and about July 1 near the Canadian border (Fig. 3), except in a northern Great Lakes area and the Pacific shore which have no summer.

Hot summer (24-hour means above 75°) is lacking in much of the North and West (Fig. 4) but is attained about May 15 near the Gulf and about July 1 in a curved zone that extends from New Jersey to Nebraska.

<sup>1</sup> Six Standard Seasons of the Year. *These Annals*, Vol. 38 (1938), pp. 165–78. States has six seasons, if based upon the commonly used descriptive tempera-

<sup>2</sup> C. F. Marvin: Normals of Daily Temperature. *Monthly Weather Rev. Suppl.* No. 25, 1925.

The average dates on which hot summer, summer, "Indian summer" and autumn end are shown in Figures 5-9. Hot weather lasts until September in the South, down to about the 30th parallel, below which it lasts into October. Summer ends, according to Figure 6, in late August near the Canadian border, but in November at the south. Warm early autumn (Indian summer) ends in October in most of the North, but not until December in the South; indeed the coastal areas of the Gulf (and of southern California) normally do not cool below 50° (Fig. 7).

Winter begins in November in much of the north and in December in a central zone, but, as already remarked, is lacking in the South and in the Pacific coast (Fig. 8). Figures 9 and 10 show the dates of the beginning and end of "cold winter" (mean daily temperatures of less than 20°).

The number of days of each year having daily normal temperatures of each of the types here considered is shown on maps 11-15. Winter (normals below 32°) is lacking in about a third of the country (Fig. 11), but in a large northern area it prevails more than a third of the year. Spring-fall cool weather (32°-50°) prevails for about four months (about two months in the spring and two in the fall) in a narrow somewhat central zone, from which zone it decreases gradually northward and sharply southward (Fig. 12). Such cool temperatures prevail for five or six months in much of Washington and Oregon and about five months in a belt from New Jersey to central Kentucky. Warm weather (50°-68°) prevails less than 100 days in a year in a large central area from which it increases in all directions (Fig. 13). The Pacific Coast has the greatest number of such days, much of coastal California having more than 300 per year. Summer (68° or higher) prevails more than half of the year near the Gulf but is lacking on the Pacific coast north of southern California and in three northern areas, the largest of which is in the Upper Great Lakes (Fig. 14). Very hot weather (during which the normals—average of day and night—are 75° or higher) are lacking at the north and along the Pacific Coast, but prevail about a third of the year or longer in the Deep South (Fig. 15). Cold winter (normally below 20°) occurs in about a fourth of the country (see Figures 9 and 10), continuing for more than 100 days in an area extending from northeastern Montana almost to Lake Superior, and for more than 50 days in most of Wisconsin, South Dakota and Wyoming.

Figure 16 affords a sort of summary of the foregoing maps. The Deep South, with daily normals above 50° has no winter or spring-fall. It has summer (means above 68°) and hot summer (means above 75°). Most of the South lacks winter (means below 32°) and hence a cold winter (means below 20°). A broad central zone has all seasonal types except cold winter.



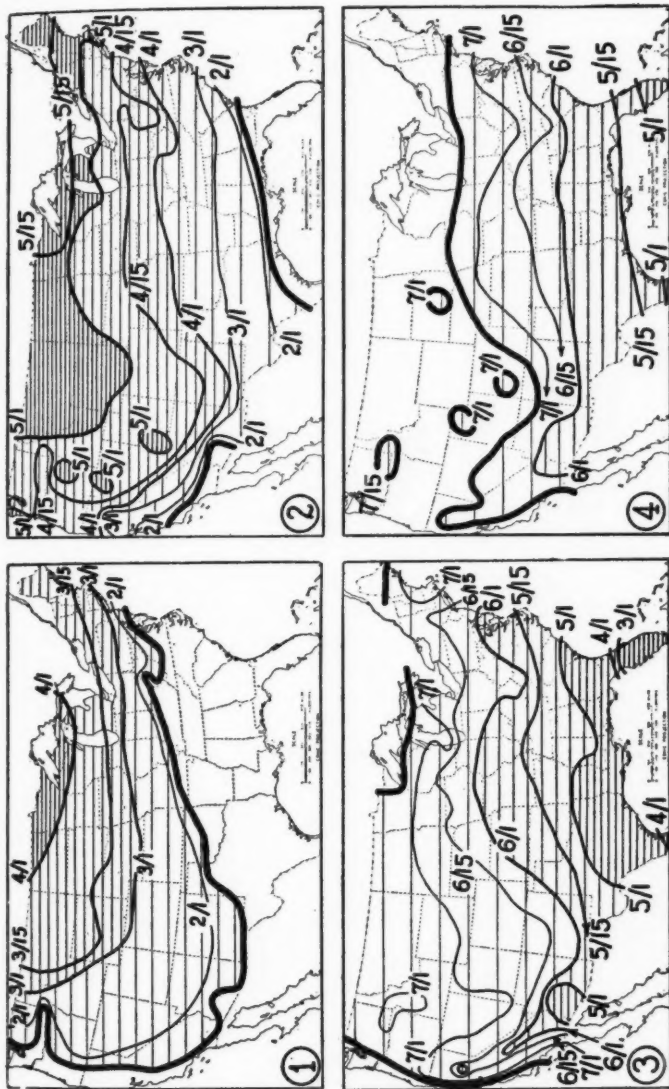


FIG. 1.—Normal date of the beginning of Spring (normal mean temperatures (day and night together) rise above 32°).

FIG. 3.—Average date of the beginning of Summer (daily normals above 68°).

FIG. 2.—Average date of the beginning of warm weather, Fore-summer (daily normals above 50°).

FIG. 4.—Average date of the beginning of Hot Summer (daily normals exceed 75°).

Much of the north lacks hot summer, and a small part of it lacks summer. Most of the Pacific coast lacks both summer and winter. (Various high western mountain ranges also lack summer, while some valleys have some hot summer.) This map is considerably more detailed than one by Jefferson

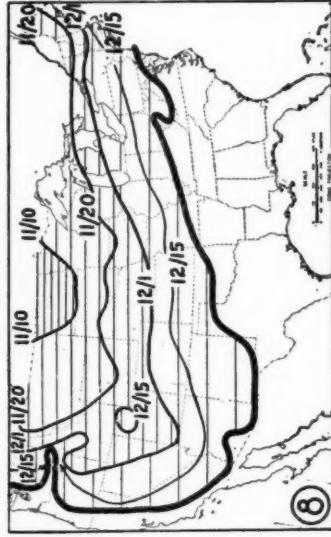
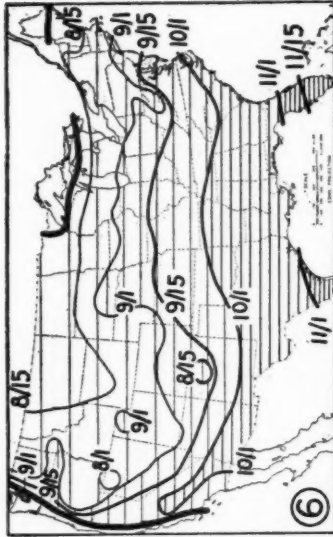


FIG. 6.—Average end of Summer (daily normals fall below 68°).

FIG. 8.—Average beginning of Winter (daily normals fall below 32°).

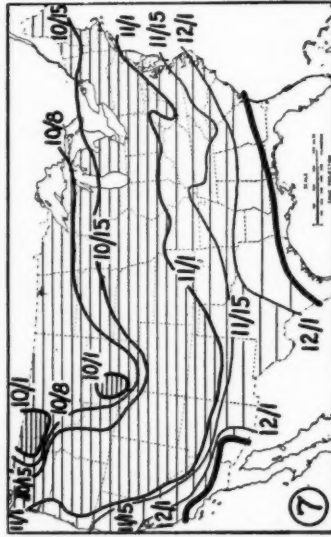
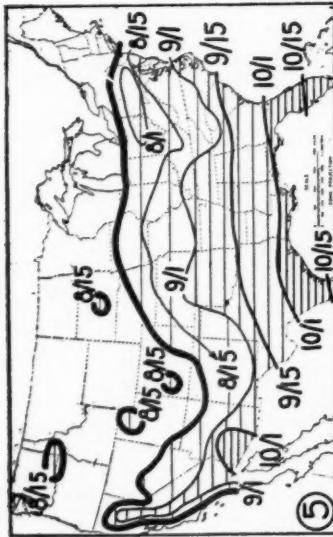
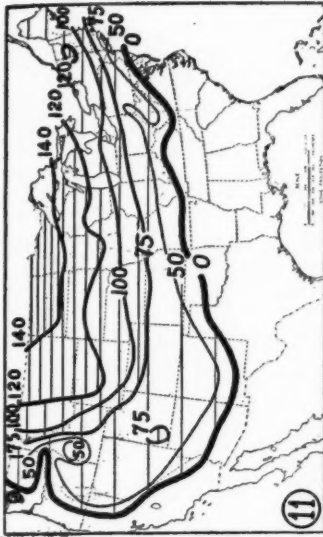
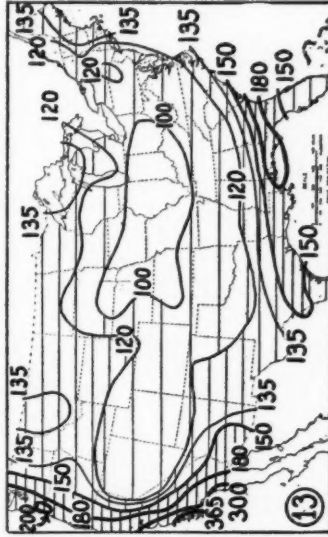


FIG. 5.—Average end of Hot Summer (daily normals fall below 75°).

FIG. 7.—Average end of Indian Summer (daily normals fall below 50°).



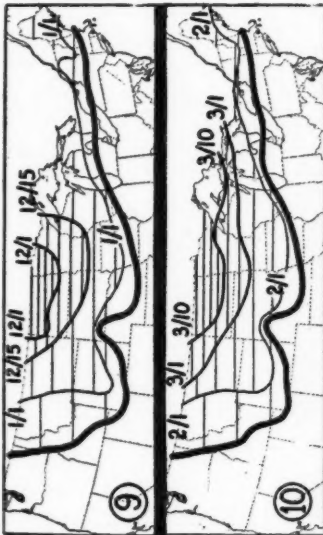
(11)



(13)

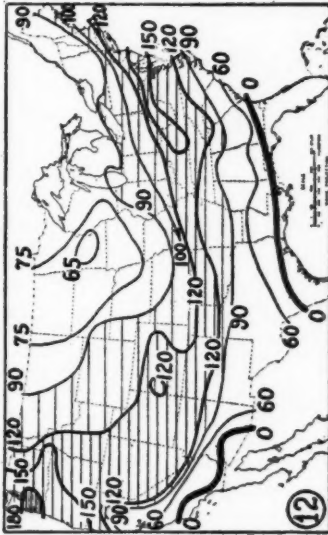
FIG. 11.—Average duration (days) of Winter (sub-freezing normals).

FIG. 13.—Average duration (days) of warm weather (daily means of 50°-68°).



(9)

(10)



(12)

FIGS. 9, 10.—Average beginning and end of Cold Winter (daily normals below 20°).

FIG. 12.—Average duration (days) of Spring-Fall (daily normals of 32°-50°).

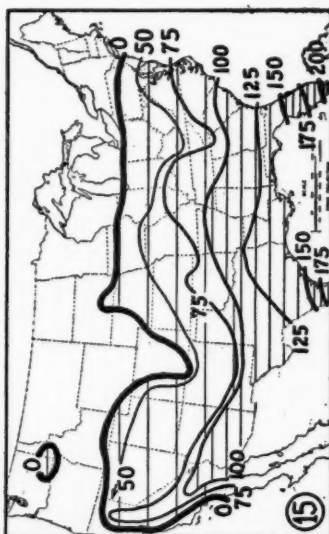
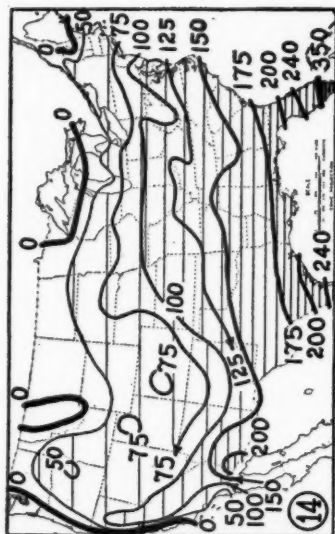


FIG. 14.—Average length of Summer (days) (daily means of 68° or higher).

FIG. 15.—Average duration of Hot Summer (daily means of 75° or higher).

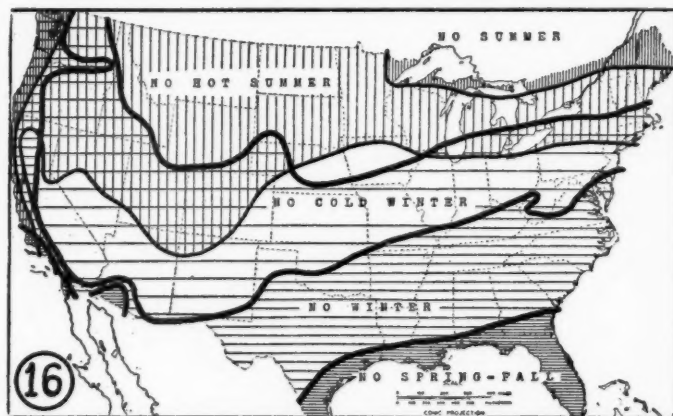


FIG. 16.—Types of seasons based on daily normal temperatures and the limits here used.

("Standard Seasons," these *Annals*, Vol. 28 (1938), pp. 1-12) since he classes as winter the days with normals below 50° and did not recognize two types of summer.

Indiana University, Bloomington  
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